

Effect of Handedness on Intelligence Level of Students

Saba Ghayas and Adnan Adil

University of Sargodha, Sargodha, Pakistan

The present study aimed at finding the effect of handedness on intelligence level of students. The sample consisted of 150 intermediate, graduate, and post-graduate students of Sargodha district including an equal number of left and right handers. Laterality Assessment Inventory and Raven Standard Progressive Matrices Test were used to assess handedness and intelligence respectively. Results indicated that left handed participants were significantly more intelligent than the right handed participants ($p < .05$) and time taken by the right handers was significantly greater than that of the left handers ($p < .05$). ANOVA showed nonsignificant difference between the intelligence of students at different educational levels.

Handedness is the natural or biological preference for using one hand more than the other in performing special tasks depending on which hemisphere is dominant for the task (Rice, 1998). People are said to be right handed if they use right hand most of the time, and left handed if they prefer left hand. People are referred to be *ambidextrous*, if they use both hands equally well and approximately on equal amount of the time.

Correlation of biological traits with the handedness proves the relationship between handedness and biology (Jaffe, 1998). Cerebral cortex of the forebrain, which controls intellectual, motor and sensory functions, is divided into two hemispheres with a contralateral control of the body. The two hemisphere of the brain each perform specialized functions. Lateralization is the preference for using one side of the body more than the other in performing special tasks depending upon, which hemisphere is dominant. The reason why lateralization occurs

is not yet clear (Rice, 1998). Lateralization is biologically programmed from the day a baby is born. This dominance and preference of one of the two hemispheres is directly connected with the body's preference of handedness and it is immutable (Cardwell, 2003).

As handedness is biologically and genetically linked, so it has various effects on one's behavior and abilities. There are different points of views about its effects. Popular culture has become fond of the idea that people and their native abilities may be described as either right or left brained. No doubt left handedness is associated with a lot of disadvantages but various studies have shown that left-handedness is also associated with enhanced abilities. Increase in ratio of left-handers can produce a corresponding intellectual advance and leap in the number of mathematical sporting or artistic geniuses. The reason is that right handers have genes that force their brains into a slightly more one sided structure but brains of left handers are

more symmetric where the two sides are more equal which enhances person's abilities (McManus, 1997).

Left-handedness is also more common among musicians mathematician, professional baseball and cricket players, architects and artists (Rice, 1998). Typically left handed people are seen to be more creative, more likely to notice the size, shape and form of things, more likely to see the whole picture or concept. All these in amalgamated form show that left-handers have more power of perception as compared to right-handers. McManus (2002) also worked on the power of perception of left and right-handers. Different studies indicate that various qualities of the left-handers show the tendency of high IQ level and it is also assumed that handedness have some relationship with the intelligence level.

Many researchers have tried to study the brain functioning of intelligent people. These studies suggest that brains of highly skilled and intelligent people require less glucose energy while performing certain cognitive task. Highly intelligent people also tend to take in information more quickly and to show faster brain wave response to simple stimuli such as flash of light (Papilia, 1993).

There are some studies in which speed of processing has been directly linked to central nervous system functioning and to intelligence (Vernon, P.A, & Mori, M. (1992). Intelligence, Reaction times and peripheral nerve conduction velocity as cited in Bee, H. (2000). *The developing child*. (9th ed.). Boston: Allyn and Bacon). Research shows that the speed with which people are able to retrieve information is related to intelligence. In general people with higher IQ scores react quickly on the information processing and perceptual task (Hunt,1997). Studies have shown that during perceptual tasks, right hemisphere is more activated so intelligent people may have more specialized right hemisphere (Barlow, 2001). Intelligence is not a consistent construct

from the birth till the death. There are different factors, which contribute to the inconsistent nature of IQ.

It is considered that left-handers are more intelligent than right-handers because of different abilities which naturally exist in them but some studies proved that the average intelligence of left handers is fractionally lower than that of right handers; though at the top end of the intellectual spectrum they do better (McManus, 1997). Some researchers have been working on this subject and are convinced that the proportion of left handers is rising and left handed people as groups have historically produced an above average quota of high achievers (McManus, 2002). Left-hander's brains are constructed differently in a way that widens their range of abilities and the genes which determine that left-handedness also govern development of the language centers of the brain. According to McManus (1997), the increase in the proportion of left-handedness could produce a corresponding intellectual advance and a leap in the number of mathematical, sporting or artistic geniuses. A significant advance in the analysis of brain-behavior relationships was made by the research and these investigations showed that left hemisphere lesions tend to be associated with lower verbal than performance IQ on the Weschler scales ($V < P$). In pattern ($V > P$) predominately in groups with lesions in the right hemisphere and with diffused brain damage (Reitan, 1955). Annett and Marian (1993) gave the theory that individuals heterozygous for the right shift gene are intellectually advantaged. The bulk of research on the topic leads to new findings, some directly contrary to assumptions of related to strong relationship of left-handedness and intellectual giftedness.

A study was done on Annett's theory that left-handedness is maintained by a balanced polymorphism and left-handers are intellectually more advantaged. In this study

($N= 429$) undergraduates were given tests assessing hand preferences, hand skill, skill asymmetry, and intellectual ability. Results showed no evidence to support Annett and Marian contention that handedness is maintained as a balanced polymorphism by the intellectual advantage shown by heterozygous relative to homozygote (Annett & Marian, 1993).

In a thorough review of the research on handedness and intelligence, it is concluded that there was no consistent link between IQ and handedness (Cole, 1997). As a whole left-handed people are not more or less intelligent than right handed one's, and on average both are equal (Needleman, 2001). Research has shown that there is nonsignificant relationship between the handedness and intelligence, and there is no difference between left-handers and right-handers in terms of intelligence and abilities that can be detected (Hurlock, 1978).

It has been proposed that perception has direct relationship with the intelligence of a person and studies have indicated that perceptual power of left-handers is more specialized than that of right-handers because of the dominance of right hemisphere (Myers, 2001).

Educational experiences are positively correlated with scores on IQ tests and informational processing task. Nevertheless, most IQ differences that are of concern are those that are well within the normal range and might be systematically modified by optimal structuring of the learning environment (Murphy, 1998). Different studies acknowledge a crucial role for environment in the development of intelligence and it is further supported that IQ can be improved by training. It is stated that IQ influence by the length of time person passed in school so indirectly it means that education affects the level of intelligence (Steinberg, 1990).

Researchers investigated IQ test performance with respect to the educational level, health, and mood states. Factor analysis revealed that IQ test performance was dependent primarily on education and to a lesser degree health and mood. At post-test education became an even mere significant factor and health and mood more non significant factor (Gunther, Christiana & Gunther, 1981).

The review of literature about the abilities and traits of left-handers indicate their high intelligence level but because of inadequate research, the results are not conclusive. The present study was conducted in order to find the relationship between the handedness and intelligence of students. It was, therefore, hypothesized that the left-handers would have higher levels of intelligence and would demonstrate higher speed of information processing. The study further explored the impact of education on the intelligence of students.

Method

Sample

A sample of 150 students including equal number of left-handed and right-handed students was drawn from various schools, colleges and universities of Sargodha district by purposive sampling ($N = 150$, mean age = 19.6 years). The sample was gender free and was divided into three groups of equal size with respect to educational level which ranged from intermediate to post- graduate. All the participants were treated in accordance with the "Ethical Principles of Psychologists and Code of Conduct" (American Psychological Association, 1992).

Instrument

The handedness of the students was assessed through the administration of Laterality Assessment Inventory (Sherman & Kulhavy, 1976) which has been found to be a valid and reliable instrument for the

assessment of laterality. Raven Standard Progressive Matrices Test (Raven, 1938) was administered in order to measure the intelligence of left and right-handers. The RSPMT has consistently been found to be a reliable and valid measure of intelligence. Raven Standard Progressive Matrices Test (RSPMT) consists of 60 problems divided into 5 sets, each of which comprises of 12 problems; arranged in ascending order of difficulty. The score on RSPMT ranges from zero to sixty.

There is a large accumulation of published research on RSPMT; the studies are scattered and heterogeneous, having been designed for a variety of different purposes. In general retest reliability of RSPMT in groups of older children and adults that were moderate homogenous in age ranges approximately from .70 to .90, which shows the high reliability of this test. Internal consistency reliability coefficient is mostly in the 0.80 and 0.90s correlation. A study was done on the correlation of RSPMT with the other verbal and performance tests and results showed the coefficient .40 and .75 respectively several factorial analysis suggest that the RSPMT is heavily loaded with a factor common to intelligence measures (Anastasi, 1997).

Procedure

The participants of the study were personally contacted. Before administering the Raven Standard Progressive Matrices, required personal information was obtained through the demographical sheet and the confidentiality of their information was ensured. They were briefed regarding the nature and objectives of the study.

The participants were asked to take RSPMT according to the instructions written at the beginning of the test. Test was administered in 75 separate setting and in each setting one left and one right hander took the test, by choosing the suitable option

or item in all the sixty problems. The participants were apprized for their cooperation and support in the study.

Results and Discussion

In order to determine the differences in the intelligence level of the participants, t-test was applied on the scores of left and right-handed subjects. The obtained score of the present study ranged from 12 to 57. Findings revealed that the major hypothesis of the study was supported as the left-handers turned out to be more intelligent than the right-handers { $t(148) = 2.15, p < .05$ }

The results of the present study are consistent with earlier work on hundred thousands and twelve participants (Bower, 1993). The specified age of participants was thirteen years. Results identified nearly 300 participants who were high scorer on the Scholastic Aptitude Test (SAT). Twenty percent of these top-scoring participants were left-handers. The approximate proportion of left-handers in the general population is 10% and the finding of the study showed the ratio of left-hander top scorers twice the ratio of left-handers in the general population. Due to negative attitude towards the left-handedness, people are not ready to assume that left-handedness can contribute to higher

Table-1: Mean, Standard Deviation and t-Values of Students' Scores on RSPMT (N = 150)

Handedness	<i>n</i>	<i>M</i>	<i>SD</i>	<i>t</i>
Left-handers	75	44.2	8.80	2.15*
Right-handers	75	39.8	12.36	

$$df = 148, * p < .05$$

intelligence level. Annett, & Manning, found that the highest means were in children with (R-L) difference. The costs of rs++ genotype seemed to include risks to verbal as well as non-verbal qualities, that is, intelligence. This prediction was confirmed for the sample of the

study; scores for Raven Progressive Matrices and for several tests of education progress was significantly poorer in mild dextral, the overall trends in all cases being a decline from left to right across the R-L continuum.

Time taken by the students during the performance on intelligence tests was analyzed with reference to their handedness. The time taken by the students during the test (RSPMT) ranged from 5 to 75 minutes. The t-test demonstrated a significant difference in the amount of time consumed by the left and right handed students in accomplishing the RSPMT as right-handers significantly took more time for the accomplishment of test than the left-handers { $t(148) = 2.88, p < .01$ }.

Table-2: Mean, Standard Deviation and t-Values of Time Taken by Students in Accomplishing RSPMT (N = 150)

Handedness	n	M	SD	t
Left-handers	75	32.44	13.92	2.88**
Right-handers	75	40.24	12.13	

$df = 148, ** p < .01$

Thus the second hypothesis of the study i.e., the time taken by the right handers would be greater than that of left handers was supported. The speed of the accomplishment of the test elucidated that the perception of left-handers is faster than that of the right-handers. In a study of split brain patient in relevance to left and right-handedness, all the participants were given same perceptual tasks. Left-handed patients rearranged some blocks easily to match a drawing but when the right-handed participants tried to match the same drawing, they made many errors (Sperry, 1982). This study indicates the perceptual superiority in the left-handers and supports the present findings. From physiological viewpoint, it has been documented that when a person performs a perceptual task, the activity level of brain waves, blood flow and glucose consumption increases in right hemisphere (Feldman, 2003). In the brains of right-handers, left hemisphere is dominant whereas in the brains of left-handers right

hemisphere is dominant, the right hemisphere dominance can also be a factor for the higher speed of information processing of left-handers because right hemisphere controls all the perceptual functions of the body (Myers, 2001). The present findings revealed the same i.e., the right-handers had lower perceptual speed because of which they took more time during the accomplishment of test.

The acceptance of afore mentioned hypotheses of the present study supports each other, as researchers have showed that intelligence and information processing speed has a direct relationship. Different researches showed that perceptual speed is enhanced in intelligent people (Richard, 1991). Perceptions of stimulus in highly intelligent people reflect greater neurological speed. Repeated studies showed that the brain waves of intelligent people register a simple stimulus more quickly and with creative complexity (Barlow, 2001). The study revealed that intelligent people have high creativity levels. Other related studies tend to support the view that intelligence and creativity are not exclusively independent characteristics (Lugo & Hershey, 1974). It is viewed that in general, people with high intelligence scores do well on the creativity tests (Myers, 2001). Creativity and intelligence both are not always dependent upon each other but it is evident from researches that highly intelligent people do any task with more creative complexity.

Subjects of the study were divided into three groups with reference to their educational level, which were intermediates, graduates, and postgraduates. The score on the intelligence tests of all three groups were analyzed comparatively.

Table-3: Means and Standard Deviations of Scores of Students of Different Educational Level on RSPMT (N = 150)

Educational level	M	SD
Intermediate	39.33	10.08
Graduate	41.41	13.35
Postgraduate	43.93	9.01

One-way analysis of variance revealed that there is no effect of educational level on intelligence level of students $\{F(2, 147) = 1.38, p = n.s.\}$. The results were contrary to the hypothesis of the present study, i.e., the participants with high education level would score higher than the students with lower educational level. The findings of the study resembled with a study done by Woodworth (1949) to perk up his tests and principle test for literate men. Some of the men tested, did not get good scores because of inadequate schooling. Some achieved grade one scores who had not even completed grammar schools and some college graduate made only average scores. More imperative is the fact that a great young men who proved exceedingly intelligent, had not gone beyond the secondary school. From the results of present study it is evident that intelligence cannot always accrue with the educational level. An extensive body of data has accumulated showing that over the elementary high school and college period performance on intelligence tests is quite stable (Bernstein & Hogarty, as cited in Anastasi, 1997). Education gives knowledge and knowledge contributes to intelligence. It is the application of knowledge rather than just possession of it, which plays a crucial role. It means intelligence level of a person cannot be predicted on the basis of his qualification or academic degree.

Research instrument that has been used in the present study, might have contributed to the findings of present study. Raven Standard Progressive Matrices Test involves the apprehension of figures and in apprehending these figures education and knowledge does not play vital role. In performing the other standardized intelligence tests, knowledge play important role as compared to RSPMT such as Wechsler Adults Intelligence Scale (Wechsler, 1955). RSPMT consists of figures which does not require much knowledge but majority of other tests

consists of those items which need specified knowledge.

The participation of students with different academic achievement record might have contributed to the rejection of fourth hypothesis. The departments that have high merits of admission than those of others also participated in the study. The students with bright academic record and high achievement level are common in these departments. It is considered that educational success is correlated with the intelligence level (Rice, 1998); therefore their involvement might also afflict the results of the present study.

Conclusion and Suggestions

The results of the present study suggest a confident step for the future research on handedness. The common attitude of people towards the left-handedness is somewhat negative that is why the traits of left-handers are underestimated. It can safely be argued that a great deal of research is needed to be done on the relationship of intelligence and handedness. The accumulated research findings will go a long way in improving our understanding about left-handedness and its consequences. Different ergonomic interventions should be designed to facilitate the participation of left-handers in the right-handers' dominated world. The future research should focus upon the relationship that may exist in different types of intelligence as proposed by modern theories and handedness to generate more interesting and deep insight into the topic. Furthermore, the present findings point to the significance of the role of lateralization that must be further explored in relation to intelligence.

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